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## Revision or Revolution? A Note on Behavioral vs. Neoclassical Economics

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**SCHUMPETER DISCUSSION PAPERS**

## **Revision or Revolution?**

# **A Note on Behavioral vs. Neoclassical Economics**

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# **Revision or Revolution?**

## **A Note on Behavioral vs. Neoclassical Economics**

### **Abstract**

Behavioral economics, the analysis of economic decisions, has made enormous progress over the last decades and become accepted as a major field in economics. How is behavioral economics to be compared to the neoclassical model? As a revision of the neoclassical model enhancing the set of variables for motivation such as fairness in the utility function which is then to be maximized? Or is behavioral economics a revolution, a departure from the neoclassical axioms, a new model? This paper argues that many of the findings in behavioral economics are incompatible with the neoclassical model and have paved the way for a revolution in economics.

### **1. Introduction**

### **2. The Behavioral Assumption of Neoclassical Economics**

### **3. Behavioral Economics**

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## 1. Introduction

The literature in behavioral economics has grown over the last decades and seems to show consistent patterns that are not easily reconciled with the axioms of behavior in neoclassical economics. How should the results of behavioral economics be evaluated. Are they an extension of or an alternative to neoclassical economics? The essence of neoclassical economics is optimization: maximization of utility (profit) under constraints and equilibrium; market clearing. Individuals have a clear and stable order of preferences and evaluate possible choices according to their individual utility, profits respectively. In short, the motivation for activity is the own utility independent of other individuals (societal behavior and values). Interaction in society is restricted to price effects<sup>1</sup> influencing the budget constraints and thus the individual optimum but not the preferences.<sup>2</sup> The methodology is individualistic and deductive and it is claimed that “good economics” needs to be based on microeconomic principles (optimization and equilibrium). Individuals are assumed to behave rationally, using the full set of information available and deciding according their own interest, *homo oeconomicus*, therefore the observed individual choices must optimize utility (profits). The behavioral assumptions of the neoclassical model became the benchmark in economics; a series of articles discussing issues that do not square with the neoclassical axioms are classified as anomalies.<sup>3</sup>

“In our reading, economists have accorded the assumption of rational, self-interested behavior unwarranted ritual purity, while alternative assumptions – that agents follow rules of thumb, that psychological or sociological considerations matter, or that, heaven forbid, they act downright irrationally at times – have been accorded corresponding ritual impurity.” (Akerlof/Yellen 1987: 137)

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<sup>1</sup> Nominal prices (wages) magnitudes are irrelevant; relative prices, real prices are the basis for decisions.

<sup>2</sup> Also, abstracting from adjustment processes (or using the metaphor of the auctioneer) a Walrasian general equilibrium excludes quantity limitations, which is a major distinction to Keynes's economics (see Howitt 1991).

<sup>3</sup> *Anomalies* is the title of the series on anomalies in the *Journal of Economic Perspectives*.

Behavioral economics may be characterized as experimental and descriptive in that human behavior shall be realistically described. To test whether individuals behave as assumed in the neoclassical model is central to the behavioral economics research program. It concentrates on individual decision making and may be interpreted as an effort to develop alternatives for the overly abstract, unrealistic assumptions of *homo oeconomicus*. It investigates motivation for choices and action and integrates insights from other disciplines. Behavioral economics aims to understand how individuals decide and act and how markets function. It includes concepts as bounded rationality, norms, framing, socially embedded individuals and their interaction, routines, and heuristics. Behavioral economics therefore has roots in (old) institutional economics, which also placed individual economic behavior into a social context and allowed for a large set of motivations (e.g., Veblen 1899).<sup>4</sup>

Behavioral economics has produced a stunning number of studies showing anomalies recognized among economists who classify themselves as neoclassical and believe that the motivations of economic agents need to be enhanced giving the regularities in behavior coming from studies in behavioral economics. Is it possible to integrate the insights of behavioral economics into the neoclassical framework or is it too much of a deviation from neoclassical axioms? Is a revision of the neoclassical model possible or does it require a revolution? The answer to the question of “revision or revolution” depends on the definition of the core of the neoclassical model and of behavioral economics. Many behavioral economists see behavioral economics as an extension of neoclassical economics allowing more accurate models. If the issue is to enhance the motivational components, revision seems possible. However, simply accepting additional variables that may affect individual utility does not apply for behavioral economics, at least as defined here. Becker is famous for applying the neoclassical methodology to social issues but he

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<sup>4</sup> The term “behavioral economics” as used here is interpreted broadly including authors such as Herbert Simon, Thomas Schelling, Edward Chamberlain, Reinhart Selten, Richard Nelson and Sidney Winter as well as “old institutional” economists like Thorstein Veblen, George Katona, James Duesenberry, and Tibor Scitovsky.

would hardly be called a behavioral economist, because he applied the axiom of maximization, the core of neoclassical economics to non-economic issues. If, however, behavioral economics contradicts the axioms of the neoclassical model, the outcome most likely will be a paradigm shift (in Kuhn's sense) replacing the neoclassical one. Pesendorfer (2006: 13), a neoclassical theoretician, argues for setting aside the insights of behavioral economics because "[t]here is no 'small' modification of the standard model that can deal convincingly with the hypothesis that people are wrong about their objective function or process probabilities incorrectly."

Behavioral economics, although producing important insights and regularities is far from a unified theoretical model. Critiques of behavioral economics come from neoclassical economists but also from psychologists who see the approach as excessively output-oriented and guilty of applying the "as-if" assumption. This paper proceeds as follows. The second section describes the core behavioral axioms of neoclassical economies. The findings of behavioral economics are presented in the third section. The last section discusses whether the paradigms are compatible or contradictory.

## 2. The Behavioral Assumptions of Neoclassical Economics

The behavioral foundations of individual choice are extremely limited in neoclassical economics, as the term *homo oeconomicus* illustrates. Behavior is deduced from first principles and based on methodological individualism. Economic agents are supposed to maximize their own utility subject to a budget constraint: optimization. Optimizing requires well-shaped stable preference curves, meaning that individuals must evaluate all possible choices and their consequences before choosing among a myriad of options. Furthermore, expected utility when buying must not change when owning the product. The individual is socially isolated, selfish and her preferences are independent of the preferences and behavior of others. Optimizing individual utility is equated with rationality and only rational individuals inhabit the neoclassical world. Actually, assuming perfectly competitive markets, only the efficient - rational - behavior can survive. Utility is abstract, not defined and often assumed to be ordinal.

Making rational choices requires well defined stable preferences also over time, meaning that the possession and use of a good must leave preferences unchanged. In other words, the utility when the decision to buy is made and when the good is actually possessed must be identical. Before and after utility is assumed to be identical, choices are unbiased, not influenced by present conditions. Behavioral economics, however, shows that the possession changes the evaluation of goods (endowment effect, Kahneman/Knetsch/Thaler 1991). Not only one's own future preferences need to be known but also full information of the usefulness of a good is necessary. There should be no surprises after buying the product. Changes in preferences because of habit formation or because the possession of a product changes its evaluation for the owner should not occur. "Rational choice", the supposed maximization of (expected) utility related to an observed specific choice is indirect, because utility functions are unobserved, it is assumed that observed choices are utility-maximizing.

Becker applied rational choice to traditionally non-economic issues like discrimination, education (human capital investment), time allocation and addiction (e.g. Becker 1965, Becker 1993). In an article with Murphy (1988), Becker argued that drug addiction is rational. Drug addicts maximize their present utility, knowing that they will face problems in the long run but they simply discount future utility at high rates. They are rational, so they maximize. This reasoning is consistent with other applications of “rational choice” in neoclassical economics but is it an explanation or simply a circular argument? Explaining drug use in terms of deduced utility maximization with an unobserved variable – discount rates -- can satisfy the believer but not the skeptic. Why would many drug addicts knowing their future utility choose withdrawal treatment? Did their preferences change, are they unstable, did the discount rate change? Does the assumed perfect self-control not hold?<sup>5</sup>

How can one investigate whether observed choices are actually utility maximizing?<sup>6</sup> One way is to ask individuals what the intention of their choices was, what motivated their behavior, did they actually try to maximize their utility, and did they perform the necessary evaluation of alternative choices. However, such investigations of motives were regarded with skepticism in economics, (see e.g. Bewley 1999, Flanagan/Strauss/Ulman 1974). Instead of investigating motivation, neoclassical economics took an axiomatic approach. We assume individuals maximize utility and therefore observed behavior is utility maximizing. When confronted with descriptions of actual choice processes which usually do not confirm the assumed evaluation process, the explanation was that people do not actually perform the required steps for “rational” decisions but rather behave “as-if.” Friedman (1953) argued that the axioms of a theory cannot be tested, they are instrumental. In other words, a theory cannot be true or false, it is merely an instrument for predictions of observable behavior. It is not descriptive. “Truly important and significant hypotheses will be found to have ‘assumptions’ that are wildly inaccurate

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<sup>5</sup> See the section on “Behavioral Economics” where self-control, changes in preferences, discount rates are discussed.

<sup>6</sup> Utility is abstract and usually unspecified. An allegation therefore is, that maximization (of abstract utility) is meaningless unless it is specified (Solow 1978).



descriptive representations of reality, and, in general, the more significant the theory, the more unrealistic the assumptions (in this sense).” (Friedman 1953: 8) The worse descriptively a theory is, the more important it is?<sup>7</sup> Friedman offers the famous example of a professional billiard player who does not perform the physical calculations for the path of the balls but somehow he knows; he behaves “as-if.” Applied to economics, the agent does not perform all calculations but she behaves “as-if” she would. Gigerenzer (several papers, Berg/Gigerenzer 2010) argues that a professional baseball player never thinks about ballistics nor does he perform “as-if” calculations to determine where the ball will come down and then runs to the calculated location to catch it. Instead the baseball player uses gaze heuristics: simply watch the ankle to the ball (Gigerenzer/Selten 2001) and move accordingly.<sup>8</sup>

Samuelson (1963) criticizes Friedman’s “as-if” defense of neoclassical “rational choice” assumptions and especially his praise of the shortcomings of a theory (see Wong 1973). Samuelson accepted that a theory can be useful even when its assumptions are unrealistic. But can more unrealistic assumptions make a theory better? Samuelson’s “F-twist” – Friedman’s methodological position -- claims that the predictions or consequences of a theory can only accidentally be valid if the theory and its assumptions are not. Simon (1963) remarks that Friedman’s claim that the prediction of his theoretical assumption – that market outcomes are profit-maximizing -- is empirically true or false. “No one has, in fact, observed whether the actual positions of business firms are the profit-maximizing ones; ...” (Simon 1963: 230). If then it is assumed that the outcome – profit-maximizing positions -- is valid, it must follow from empirically valid assumptions but the empirical evidence shows that the assumptions are false. Anyhow, there seems to be confusion whether economics is a logical-mathematical science where “... “truth” is a logical criterion. A conclusion is ‘true’ if it follows from the premises

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<sup>7</sup> “When verification is demanded, they (neoclassical economists, RS) tend to look for evidence that the theory makes correct predictions and resist advice that they should look instead directly at the decision mechanisms and processes.” (Simon 1986:38)

<sup>8</sup> Karl Popper: instrumentalism forces scientists to abandon the search for truth (cited according to Caldwell 1980: 370)

by means of deductions which are, after all, tautological” (Kornai 1971: 8), or whether economics is a real science where “... the only criterion of ‘truth’ is experience, the comparison of assertions with reality” (Kornai 1971: 8). “That is, only those theorems and propositions (deduced from assumptions not in conflict with reality) which describe the real world more or less accurately may be considered acceptable” (Kornai 1971: 9).<sup>9</sup>

Critics of neoclassical axioms argued that the human brain is unable to evaluate all possible choices, to bring them in a transitive order and evaluate the consequences (bounded rationality, Herbert Simon 1955, 1982). Humans have limited information and lack the computational capacity to evaluate all alternatives and their consequences. Rationality is bounded and humans may try to achieve aspiration levels – satisfying -- rather than aiming for the maximum. New York cab drivers - who can freely vary their working hours – illustrate the point: Instead of maximizing income on busy days they stop working once their income target is achieved (Camerer et al. 1997).<sup>10</sup>

Allais (1953) and Ellsberg (1961) showed in early experimental studies that many (most) individuals do not behave in a manner consistent with Savage’s axioms’ decision-makers do not adhere to the axiom of rationality, and that therefore the person’s choices cannot be attributed to maximizing his utility function under subjective probability. In an experiment in which participants had to choose successively in two lotteries which differed from each other only by an irrelevant additional option with a high probability, Allais (1953)<sup>11</sup> found that subjective expected utility (SEU) is violated because the criteria for the decision changed from the expected payment to the higher probability resulting in contradictory choices known as Allais’s paradox. This irrational behavior led Kahneman and Tversky (1974, 1979) to develop “prospect theory” (see below). Another forerunner of behavioral economics is Ellsberg

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<sup>9</sup> Kornai, himself a mathematical economist, emphasizes: “It is one thing, however, to suggest that logic and mathematics serve a crucial role in the real sciences and quite another to assert that the same criterion of truth is relevant to both types of theory” (1971: 8/9).

<sup>10</sup> Winter-Ebner (2014) argues that taxi drivers are probably specific and not representative of workers. True, they are among the few workers with flexible working hours where the aspiration level hypothesis can be tested.

<sup>11</sup> Allais’s experiment was among the first in economics. Even earlier was the experiment by Chamberlain (1948) at Harvard.

(1961) who argued that decisions differ under risk and ambiguity (uncertainty). Similar to Keynes's distinction between decisions under risk and under uncertainty (see also Knight, 1921), Ellsberg argued that human decisions suffer from an aversion to ambiguity.<sup>12</sup>

### **A typical defense of the neoclassical approach**

In his discussion of behavioral economics from the perspective of a neoclassical theoretician, Pesendorfer (2006) argues that variables identified as important in behavioral economics research are unobservable. "..., we cannot observe variations in the reference point in the same way that experimenters can fix and manipulate the reference point" (Pesendorfer 2006: 6). True, controlling for variables is the advantage of experiments but is optimization – the most relevant variable in neoclassical economics – observable in economic data? The fundamental axiom in neoclassical economics is that individuals optimize, but optimization is not observed but rather deduced from observed choices assumed to be the result of optimization. That is, optimization is assumed but not validated and measured; therefore, potential deviations from the optimum cannot be detected. Assuming that individuals optimize and "therefore the outcomes of observed choices are optima" is a statement that cannot be falsified.

Commenting on behavioral economics Pesendorfer is right, when he argues: "Such theories are difficult to connect to economic data (which usually lags measures of utility, RS) because their main insights are about psychological variables, that is, how the person thinks (i.e., deals with biases) and feels." (Pesendorfer 2006: 3) But this is hardly a reason to refrain from the insights of behavioral economics. What he calls bias is a deviation from deduced behavior based on neoclassical axioms. That is exactly the point of behavioral economics: humans behave differently from neoclassical assumptions; their motivation is more complex and decisions systematically deviate from the

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<sup>12</sup> Ellsberg used "ambiguity" but it is similar to uncertainty or what Keynes earlier labeled in the "Treatise on Probability" (1921) as "non-comparable probabilities." Ellsberg was obviously not aware of Keynes's "Treatise on Probability" (1921) when his paper was published in 1961 (see Feduzi 2007).

deduced decision based on the neoclassical axioms. “But, whether logical or illogical, experience shows that this is how labour in fact behaves” (Keynes 1936: 9).

If preferences change with reference points, Pesendorfer argues that people refrain from solving the dynamic optimization problem of changing preferences, because it does not have clear benefit.

“In a standard model, maximizing a utility function is simply a concise representation of how the agent behaves. But once the model is interpreted as a mental process, we must imagine that the decision maker actually performs the optimization. Since the decision maker is systematically wrong about future behavior there is no obvious benefit from maximizing the objective function as opposed to taking some other (perhaps arbitrary) action” (Pesendorfer 2006: 9).

*Homo oeconomicus* rationally does not perform the optimization procedure because she knows that once she has made a decision her preferences will change around the reference point (see next section). Probably, but it follows from the Pesendorfer statement that the assumption of well-ordered and stable preferences – the basis for optimization -- cannot be kept. Pesendorfer obviously prefers to leave out psychological insights when he argues against integrating behavioral economics into the neoclassical model because “...the theory allows too many degrees of freedom” (Pesendorfer 2006: 6). That, however, is the point: the auxiliary assumptions of the neoclassical model, the static environment and the limited motivation reduces the complexity of the decision process, reducing economics to focus on situations in which the agent can be expected to “know” or to have learned the consequences of different actions so that his observed choices reveal stable features of his underlying preferences (Lucas 1986: 218).<sup>13</sup>

Optimization is the core of neoclassical economics. The questions are 1) whether individuals optimize a stable utility function; and 2) if the auxiliary assumption (Simon 1986) of a stable (static or steady) environment applies.

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<sup>13</sup> Assuming an economy at rest allowed Lucas to establish a stochastic version of perfect foresight, rational expectations (see Schettkat 2010).

### 3. Behavioral economics

The research program on behavioral economics discovered many regularities of individual economic behavior, which are difficult to square with the “rational choice” and maximization assumption of neoclassical economics. Behavioral economics is inductive and is based mainly on experiments of individual choice using insights from other disciplines, mainly psychology. The experimental approach allows to control situations but people may behave differently in experiments. A natural question is, however, whether the axiomatic approach to behavior in neoclassical economics is closer to real life than experiments. Whether individuals behave as assumed in the neoclassical model is a core of the behavioral economics research program. Behavioral economics concentrates on individual decision-making. It can be interpreted as an effort to develop alternatives for the overly abstract and unrealistic assumptions of human behavior in neoclassical economics (see e.g. Kahneman/Tversky 2000, Kahneman 2011, Thaler 1993, 2015, Camerer, Loewenstein, Rabin 2004) although some efforts have been made to include elements of behavioral economics into macroeconomics (e.g. Akerlof 2007, Akerlof/Shiller 2009, de Grauwe 20011, 2012). Behavioral economics aims to understand how individuals decide and how markets actually function, making it descriptive.

The major findings of behavioral economics may be summarized as follows:

- (1) Situations are evaluated from a **reference point**, often the status quo (**endowment effect**) and the asymmetrical utility effects of gains and losses. Losses reduce utility more than similar gains increase it (**prospect theory**).
- (2) Individuals are **socially embedded**, in that their utility depends on the behavior and judgment of other individuals and their interaction. **Fairness** may outweigh individual gains.
- (3) Discount rates depend on absolute values and time, smaller immediate rewards are valued higher than later but larger rewards and preferences may reverse (**hyperbolic discounting**).

- (4) **Magnitudes, nominal values** matter.
- (5) **Framing**: the presentation of choices affects behavior.
- (6) **Rationality** is generally **bounded**. Decisions are based on **norms, routines, heuristics**.

Probably the greatest deviation of behavioral economics from the neoclassical model is the evaluation of utility depending on reference points, which may depend on the status quo (endowment effect), the behavior and judgments of reference groups (socially embedded utility functions). Behavioral economics found that individuals evaluate losses and gains asymmetrically: losses weight higher negatively on utility than similar gains raise utility. If humans evaluate gains and losses relative to a reference point – usually the status quo -- indifference curves change their shape around the reference point. Utility maximization is already difficult in a static but complex world with a myriad of choices, but clearly much easier if preference curves are stable when they change and dynamic optimization would be required (see Pesendorfer above). Komlos (2014) presented behavioral indifference curves showing that even after initial optimization (the budget constraint is tangential to an indifference curve) kinks occur at the reference point because of the differing valuation of gains and losses. Komlos (2014) explains that prospect theory changes the marginal rate of substitution between a good X and another good Y ( $m = -\Delta Y_i / \Delta X_i$ ) because the loss in Y weights higher than the gain in X. The endowment effect implies that a substitution of X against Y requires “ex post” compared to the initial indifference curves a higher increase in Y to compensate for a loss in X.

### **Adding an argument to the utility function?**

Many neoclassical economists have not neglected the advancements behavioral economics made over the last decades and regard the motivational variables of *homo oeconomicus* as too narrow. Utility of workers for example depends on monetary variables but also on fairness, job satisfaction and others more. As early as the 1970s, Freeman (1978) showed in an empirical analysis of quits that subjective variables such as job

satisfaction “contain useful information for predicting and understanding behavior, but that they also lead to complexities due to their dependency on psychological states” (Freeman 1978: 140). Another addition to labor market analysis is “fairness” which seems widely accepted but it is not easily measured and depends on reference points. However, if fairness is violated, a person’s feeling (utility) and productivity will suffer (Solow 1979, Bewley 1999). In this case it will be rational for employers to consider the “irrational” feeling about fairness. Akerlof and Kranton (2011) argue that economics becomes more realistic if the utility function is enhanced by another variable, such as “identity.” One possibility is to assume optimizing behavior applying the usual assumption that a higher monetary income is preferred over a lower income (that the utility of higher income is greater than that of a lower income) run a regression and try to “explain” parts of the residual with additional variables similar to equations in growth accounting (e.g. Mankiw/Romer/Weil 1992).

Enhancing the motivation, however, is easier to integrate into a model of assuming maximization. Findings of decision processes deviating from “rational choice” are a much bigger obstacle. Keynes’s (1936) argument that workers resist nominal wage cuts but accept real wage reductions brought about by inflation was often interpreted as “money illusion” which is simply irrational. In a study by Shafir, Diamond and Tversky (1997), participants were asked whether person A or B -- who graduated from the same college and started jobs at the same time but had different pay increases and inflation -- was better off in monetary terms and in satisfaction. The study revealed the following answers:

Person	1 <sup>st</sup> year Salary	inflation	end year pay rise	2 <sup>nd</sup> year Salary nominal	real	Respondents thought: better off econo- mically happier prop. to quit		
1	2	3	4	5	6	7	8	9
A	30,000	0%	2%	30,600	30,600	71%	36%	65%
B	30,000	4%	5%	31,500	30,300	29%	64%	35%

Source: compilation from Shafir/Diamond/Tversky (1997) cited in Wilkinson (2008: 32/33).

The participants in the Shafir, Diamond and Tversky study understood the difference between nominal and real income (column 7) but they thought that the higher nominal income makes them happier (column 8) and they even believed that A (who was better off in real terms) would be more likely to quit a job to accept another job offer (column 9).

Forward-looking “rational choice” requires exponential discounting, in which utility far in the future should be discounted at higher rates than more immediate utility. The discount rate should increase with time. Discounting utility requires cardinal measurement and needs to assume that future utility is independent from current utility. In other words, preferences in the future are independent of preferences and action today (no path dependence, no habit formation, no reference points). Summarizing empirical discount rates from 42 studies Wilkinson (2008: 207) states: “It should be noted that the effect works in the opposite direction to the effect of diminishing marginal utility”. Time distance and diminishing marginal utility requires higher values to be discounted at higher rates.

Magnitudes also matter. The evaluation of a future payment seems to be affected by magnitudes but “rational discounting” requires discount rates to be independent of magnitude to ensure consistent results. Yet a common finding in behavioral economics is that greater amounts are discounted at lower rates than smaller amounts (Kahneman/Tversky 2000). This is the reverse of rational assumptions. Thaler (1981) found that the same persons were indifferent among the following choices:



Immediately	in 1 year	implied discount rate
15 [\$]	60 [\$]	139 %
250 [\$]	350 [\$]	34 %
3000 [\$]	4000 [\$]	29 %

Source: Thaler (1981).

The implied discount rates show an amazing variation depending on the magnitudes but in the reverse order expected under the “rational choice” assumption. The higher the amounts, the lower the discount rate. This is “money illusion” or “irrational”, but seems to be a regular pattern.

A rational individual should also not be influenced by the order in which choices are presented. Thaler and Sunstein (2008), however, showed that humans are strongly influenced by the order of choices. The arrangement of food in a cafeteria, for example, affects diners’ choice. If salad is first and hamburgers with fries are last, people eat more salad, and vice versa. Whether probabilities are presented (framed) as gains or losses also influences the decision. Humans seem to discount gains more heavily than losses. Participants in financial markets, closest to the perfect market model, show this behavior; investors prefer shares whose prices are falling.

A necessary condition for utility-maximizing choices are accurate and unbiased forecasts of the hedonic outcomes of potential choices (see Kahneman/Thaler 2006). Many findings of behavioral economics suggest that the stability assumption of preferences in neoclassical economics does not hold. The utility of buying a product may be different from the utility derived from owning it. Humans’ (expected) utility seem to be strongly affected by the situation, the mood, the environment and may change over time. “However, people do not always know what they *will* like, and they are likely to err most severely when the temporal gap is long and when the agent’s state and circumstances vary between  $t_1$  and  $t_0$ ” (Kahneman/Thaler 2006: 223). Humans often make systematic errors in predicting their future utility and thus fail to maximize their experienced utility (see Kahneman/Thaler 2006).

The perception of situations and facts is often biased. Do humans see reality objectively? There are innumerable examples even of static situations being misinterpreted. The objective obstacles to optimization are the available information, the complexity of the situation before and after a decision, time (urgency of a decision, time horizon) and subjective obstacles such as the computational capacity ("RAM") of humans to evaluate the myriad of options and their consequences. Barnard and Simon (1947) argued that in situations in which optimal solutions cannot be determined because of computational intractability or lack of information, some aspiration level will serve as the target: this is known as satisficing. In his Nobel Prize lecture, Simon (1978:350) stated:

decision makers can satisfice either by finding optimum solutions for a simplified world, or by finding satisfactory solutions for a more realistic world. Neither approach, in general, dominates the other, and both have continued to co-exist in the world of management science.

However, bounded rationality is the rule rather than an anomaly. Humans try to achieve aspiration level rather than maximizing. The levels achieved in the past but also observed levels of reference groups affect aspiration levels. Aspiration levels, reference points rise with income (Easterlin 2001). The impact of inflation on nominal pay increases is ignored. Neumark and Postlewaite (1998) tested the law of relative incomes for utility and found that a woman's decision to start paid work depends on whether her sisters and sisters-in-law are employed and how much they earn. Thurow (1975) reported results from Gallup questionnaires asking US citizens of the minimum amount of money a family of four needs to survive. Over a 17-year period, the answers fell between 53 and 59% of average income, although average income rose substantially.

Berg and Gigerenzer (2010) argue that behavioral economics applies the "as-if" assumption similar to neoclassical economics. "As-if" arguments are used to add new parameters to fit decision data instead of analyzing specific, more realistic psychological processes that genuinely explain that data. "It appears to us that many of those debating behavioral versus neoclassical approaches, or vice versa, tend to dramatize differences" (134). Berg and Gigerenzer are

correct when they argue that many contributions to behavioral economics emphasize on the “output” of decision processes instead of analyzing the decision process in depth (as psychologists would do). These outcomes are often compared with predictions of the rational behavior model -- usually contradicting it -- but the finding that other motives than that of *homo oeconomicus* are relevant does not mean that an “as-if” procedure – i.e., optimization - is assumed. Is it applying “as if” if one tests the predictions (and the assumptions) of neoclassical economics? Sure, one can get deeper into the underlying actual decisions processes but most results of behavioral economics show that the decision process is not “as-if” but systematically different from the neoclassical model, “biased” if the rational choice model is the reference.

## 4. Revision or Revolution?

Will the findings of behavioral economics lead to a paradigm shift in economics, or will they be integrated into the neoclassical model? Kuhn (1970) argued that science proceeds within a paradigm and that the dominant paradigm will integrate minor deviations. They lead to revisions but not to a paradigm shift. This has happened in the past, when for example the artificial assumption of perfect information was relaxed in the “new microeconomics” (Phelps et al. 1970) and searching in labor markets was recognized. The information lag was not treated as a fundamental deviation from the paradigm; instead, searching was quickly integrated into the maximization model by arguing that searching itself is optimized. Optimal search is where the marginal costs of searching equal its marginal benefits. “A Walrasian system with some frictions” as Friedman (1968) famously labeled it. Frictions, imperfect knowledge, were not regarded as an impediment to optimization but were integrated into the neoclassical model; just an additional equation to solve. This was more realistic than assuming full information and the absence of frictions, but it was kept within the maximization-paradigm, thus a normal extension. If the list of anomalies gets too long or if they contradict the fundamental axioms of the dominant paradigm, Kuhn argued, that there might be a shift to a new paradigm. If Economics is a real-science rather than a mathematical-logical science it is not simply logical consistence which is establishing truth but rather whether new findings do not contradict the fundamental axioms (Kornai 1971). How great are the deviations of behavioral economics findings from the neoclassical axioms? Do these findings contradict the fundamental axioms of neoclassical economics or can they be covered by the optimization paradigm?<sup>14</sup>

The core axiom of the neoclassical model is the individual’s selfish utility-maximizing selection among the myriad of alternative options along well-defined, stable preferences under a budget constraint. The motivation is utility

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<sup>14</sup> Keynes’s micro foundations of macroeconomics developed in the General Theory (Keynes 1936) have a lot in common with the findings of behavioral economics but they were simply ignored, classified as irrational or money illusion (see for a analysis: Schettkat/Werner 2018). As a result there was schizophrenia in economics: neoclassical at the micro level but Keynesian at the macro level (Howitt 1991).

maximization, but utility is only “measured” indirectly: Starting from the axiom that individuals maximize their own utility it is concluded that observed behavior must be utility maximizing. But as long as utility is not measured, the statement does not fulfill Popper’s (1959) criteria of potential falsification; it is circular. The neoclassical “rational choice” hypothesis may be investigated in several ways which are all part of the behavioral economics tool box:

**(1) Investigating the subjective motives for decisions.** What did individuals want to achieve, what were they targeting? For long subjective variables were regarded with skepticism in economics but nowadays it seems widely accepted that individuals care about more than income and profit and that these variables can contribute to understand actual behavior. Workers care about their working environment, fair treatment and even about the well-being of their colleagues. These motives may be integrated into a utility function which then may be maximized. This would result in a more complex model but the axiom of utility maximization could be kept.

**(2) Investigating the decision process.** Do individuals actually evaluate the (expected) utility connected with the myriad of alternative options consistently? Are the conditions fulfilled to undertake that process? The objective obstacles for maximizing a utility function are the available information, the complexity of the situation (before and after a decision), time (urgency of a decision, time horizon) in addition to subjective obstacles as the computational capacity (“RAM”) of humans to evaluate the myriad of options and their consequences even in a static environment. Herbert Simon’s work tackled the external and internal constraints for “rational choice” arguing that rationality is bounded. It is impossible to gather information on all alternative choices (external constraint) and it would be impossible to process that information (internal constraint).

In situations that are complex and in which information is very incomplete (i.e., virtually all real world situations), the behavioral theories deny that there is any magic for producing behavior even approximating an objective maximization of profits or utilities. (Simon 1986: 39).

The neoclassical escape from Simon's reasoning were the "as-if" argument protecting the neoclassical axioms from scrutiny. Analyzing whether agents actually perform the optimization process seems not to be regarded as relevant in neoclassical economics because it requires insights from other disciplines. However, ignorance can hardly convince the skeptic.

**(3) Observing choices in a controlled environment.** Experiments are the dominant method in behavioral economics and produced the stunning evidence on actual choices almost always contradicting the neoclassical axioms. The advantage of experiments is that variables and frames can be changed in a controlled way. Experiments can test whether humans respond differently to variations in environmental conditions, whether they may change the decision criteria, whether they vary discount rates depending on time and magnitudes, and whether preferences remain stable over time. Researchers can test whether choices are consistent or deviate. The disadvantage of experiments is that people may behave one way in laboratories and another way in the real world.

The findings reveal that humans often make systematic errors in predicting their own future utility and thus fail to maximize their experienced utility. But it is not simply error or misunderstanding of situations which let decisions deviate from 'rational choice'. It is not simply money illusion when nominal values are recognized in decisions rather can even overrule real values with respect to utility.

The following overview summarizes the different approaches of neoclassical and behavioral economics among several dimensions. Many dimensions contradict the rational choice axiom and cannot be integrated into the neoclassical model without substantial changes. They may be the seeds for a revolution from "rational choice" to a more realistic empirically substantiated paradigm.

## Overview: Neoclassical vs. behavioral economics along several dimensions

Neoclassical Assumptions	Behavioral Findings
<b>Social Status</b>	
irrelevant, selfish, socially isolated individuals	relevant, socially integrated individuals
<b>Utility-functions</b>	
independent (socially isolated)	dependent (socially embedded)
<b>Self-control</b>	
perfect	imperfect
<b>Computational Ability („RAM“)</b>	
high	limited
<b>Expectations</b>	
rational	non-rational
<b>Probability Distribution</b>	
risk	risk, uncertainty
<b>Fairness</b>	
Irrelevant	important
<b>Methodology</b>	
axiomatic, deductive, individualistic	descriptive, inductive, socially embedded
<b>Motivation</b>	
narrow	broad
<b>Preferences</b>	
stable, ordered	depending on reference points, changing
<b>Magnitude</b>	
unimportant	important
<b>Nominal Values</b>	
unimportant	important
<b>Framing</b>	
irrelevant	relevant
<b>Time</b>	
logical	historic
<b>Context, Mental State</b>	
irrelevant	matters
<b>Representative Agent</b>	
applicable	not applicable

Some motivational variables found to be important in behavioral economics integrated into the neoclassical model as addition to a traditional utility function. Other arguments – such as interdependent utility functions, aspiration levels, revers preferences, reference points -- are hard to integrate into the neoclassical framework because they destroy the Newtonian setup. Behavioral economics shows that choices are unconsciously and consciously

biased, which is no good basis for “rational choice” and call for a shift in the paradigm. However, revolution in economics are often slow, Allais published his paradox 65 years ago, Simon had already written about bounded rationality in the 1940s and Keynes proposed “animal spirits” for decisions under uncertainty 80 years ago.



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